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Self-diffusion of polystyrene in solution 2. Discussion of experimental results on the basis of the reptation mechanism and entanglements

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Abstract

The expressions for polymer self-diffusion in semidilute solutions, theoretically derived from the reptation mechanism, the blob concept and scaling considerations, are discussed and compared against experimental data from the authors' investigations and the literature. In the nonentangled (from viscoelastic data) semidilute solution, the experimentally observed concentration and molar mass exponents are in fair agreement with those derived theoretically. However, a quantitative estimation shows that the experiments cannot be explained by reptation. Experiments with polymer mixtures also give strong evidence against reptation. It is concluded, that in the nonentangled semidilute solution, the polymer self-diffusion is more complicated than simple reptation. This is also supported by recently observed long-range density fluctuations or cluster formation in this concentration region detected by scattering techniques and NMR-PFGT. In the entangled semidilute solution, the self-diffusion data are in accordance with the reptation mechanism; reptation being within a tube having approximately 20 blobs between entanglements. © 1988 Steinkopff.

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Keywords

entanglements, polystyrene solutions, reptation, Self-diffusion, semidilute solution